



Science Standards of Learning

Teacher Resource Guide

Grade One

**Commonwealth of Virginia
Department of Education
Richmond, Virginia
2000**

Grade One Science Strand

Scientific Investigation, Reasoning, and Logic

This strand represents a set of inquiry skills that defines what a student should be able to do when conducting activities and investigations. The various skill categories are described in the “Investigate and Understand” section of the *Standards of Learning*, and the skills in science standard 1.1 represent more specifically what a student should achieve during the course of instruction in the first grade. Across the grade levels the skills in the first standards form a near continuous sequence of investigative skills. (Please note Appendix, “Science Skills, Scope, & Sequence”). It is important that the classroom teacher understands how the skills in standard 1.1 are a key part of this sequence (i. e., K.1, K.2, 1.1, 2.1, 3.1, 4.1, 5.1, 6.1 and 6.2). It is also important to note that 25% of items on the 3rd and 5th grade SOL assessments measure the skills defined in the “Scientific Investigation, Reasoning, and Logic” strand.

Strand: Scientific Investigation, Reasoning, and Logic

Standard 1.1

The student will plan and conduct investigations in which

- differences in physical properties are observed using the senses and simple instruments to enhance observations (magnifying glass);
- objects or events are classified and arranged according to attributes or properties;
- observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers;
- length, mass, and volume are measured using standard and nonstandard units;
- inferences are made and conclusions are drawn about familiar objects and events;
- predictions are based on patterns of observation rather than random guesses; and
- simple experiments are conducted to answer questions.

Understanding the Standard

The skills described in standard 1.1 are intended to define the “investigate” component of all other first grade standards (1.2 - 1.8). The intent of standard 1.1 is that students will continue to develop a range of inquiry skills and achieve proficiency with those skills in the context of the concepts developed at the first grade. Standard 1.1 does not require a discrete unit on scientific investigation because the inquiry skills that make up the standard should be incorporated in all other first grade standards. It is also intended that by developing these skills, students will achieve greater understanding of scientific inquiry and the nature of science, as well as more fully grasp the content-related SOL concepts.

Standard 1.1

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• To communicate an observation accurately one must provide a clear description of exactly what is observed, and nothing more.• Simple instruments, such as the magnifying glass, can extend the observations that people can make.• Graphs are powerful ways to display data, making it easier to recognize important information. Describing things as accurately as possible is important in science because it enables people to compare their observations with those of others.• Standard measures are important for describing an object because standard measures are recognized by everyone. Many non-standard measures, such as hand or finger length, vary considerably.• An inference is a conclusion based on evidence about events that have already occurred.	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none">• use their senses and simple instruments (magnifying glass) to enhance their observations of physical properties.• classify and arrange objects or events according to at least two attributes or properties so that similarities and differences become apparent.• communicate observations made and data collected orally and with simple graphs, pictures, written statements, and numbers.• measure length, mass, and volume using standard and nonstandard units and appropriate instruments. By the third grade students will be expected to have basic facility with metric measures including centimeters, grams, and milliliters.• use familiar events and objects to make inferences and draw conclusions.

Standard 1.1 (continued)

Overview	Essential Knowledge, Skills, and Processes
<ul style="list-style-type: none">• A prediction is a forecast about what <i>may happen</i> in some future situation. It is based on information and evidence. A prediction is different from a guess.• An experiment is a fair test designed to answer a question.	<ul style="list-style-type: none">• predict outcomes based on actual observations and evidence rather than random guesses.• answer questions by planning and conducting simple experiments/investigations using basic tools and techniques. A <u>simple</u> experiment is one that changes only one thing at a time (tests only one variable), gives quick results, and provides easily observed changes.

Grade One Science Strand

Force, Motion, and Energy

The strand “Force, Motion and Energy” focuses on students understanding of what force, motion, and energy are and how the concepts are connected. The major topics developed in this strand include magnetism; types of motion; simple machines; and energy forms and transformations, especially electricity, sound, and light. This strand includes science standards K.3, 1.2, 2.2, 3.2, 4.2, 4.3, 5.2, 5.3, 6.3, and 6.4.

Strand: Force, Motion, and Energy

Standard 1.2

The student will investigate and understand that moving objects exhibit different kinds of motion. Key concepts include

- objects may have straight, circular, and back and forth motions;
- objects vibrate;
- pushes or pulls can change the movement of an object; and
- the motion of objects may be observed in toys and in playground activities.

Understanding the Standard

Physical science includes topics that give students a chance to increase their understanding of the characteristics of objects and materials that they encounter daily. Knowledge about objects develops through learning how they move and change position and shape in relation to the viewer, as when we look at objects from different angles. Students learn about objects by observing them and noting similarities and differences and by acting on them by applying force. This concept relates to science standard K.3, in which magnets push and pull objects. It is intended that students will actively develop science investigation, reasoning, and logic skills (1.1) in the context of the key concepts presented in this standard.

Standard 1.2

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• An object's motion may be described by tracing and measuring its position over time. The motion of objects may be straight, circular, curved, or back and forth.• One kind of back and forth motion is vibration. Vibrations may create sound.• Pushing or pulling can change the position and motion of objects. For the same object, the size of the change is related to the strength of the push or pull.	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none">• make and communicate observations about moving objects. Examples should include balls, things with wheels, windup toys, tops, rubber bands, and playground equipment.• predict an object's movement using its size, shape, and the force of the push or pull on it.• design and conduct a simple experiment to determine an object's movement.• describe and classify the motion of an object as straight, circular, curved, or back and forth.• understand that vibrations may create sound, such as humming, strumming a guitar, plucking a rubber band.• record observations of movement (length/distance) using standard (English/metric) and nonstandard units (for example, pennies and paper clips).• compare the movement of objects using graphs, pictures, and/or numbers.

Grade One Science Strand

Matter

The strand focuses on the description, physical properties, and basic structure of matter. The major topics developed in this strand include concepts related to basic description of objects; solids, liquids, and gases (especially water); phase changes; mass and volume; and the structure of classification of matter. This strand includes science standards K.4, K.5, 1.3, 2.3, 3.3, 5.4, 6.5, 6.6, and 6.7.

Strand: Matter

Standard 1.3

The student will investigate and understand how different common materials interact with water. Key concepts include

- some common liquids (vinegar) mix with water, others (oil) will not;
- some everyday solids (baking soda, powdered drink mix, sugar, salt) will dissolve, others (sand, soil, rocks) will not; and
- some substances will dissolve easily in hot water rather than cold water.

Understanding the Standard

Students continue their study of water by examining and qualitatively describing water and its behavior with other matter. When carefully observed, described, and measured, the properties of objects in or with water, and the changes that occur when materials interact with water, provide the necessary foundation for more abstract ideas in the upper grade levels. This concept is related to science standard K.5 in which students identify water in its different forms (solid, liquid, gas). It is intended that students will actively develop science investigation, reasoning, and logic skills (1.1) in the context of the key concepts presented in this standard.

Standard 1.3

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• Different types of materials react differently when mixed with water.• Some liquids will mix with water while others will not.• Some solids will dissolve in water while others will not.• The temperature of the water affects how easily a substance will dissolve in it.	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none">• describe and apply the term “dissolve.”• predict and describe how a variety of materials (vinegar, oil, baking soda, powdered drink mix, sugar, salt, sand, soil, rocks) act when mixed with water.• classify liquids and solids into those that will dissolve in water and those that will not. Use picture graphs, tables, and/or charts to record and display the information.• infer that some substances will dissolve more easily in hot water than in cold water by conducting investigations using different temperatures of water.

Grade One Science Strand

Life Processes

The strand focuses on the life processes of plants and animals and the specific needs of each. The major topics developed in the strand include basic needs and life processes of organisms, their physical characteristics, orderly changes in life cycles, behavioral and physical adaptations, and survival and perpetuation of species. This strand includes science standards K.6, 1.4, 1.5, 2.4, 3.4, 4.4, and 6.8.

Strand: Life Processes

Standard 1.4

The student will investigate and understand that plants have life needs and functional parts and can be classified according to certain characteristics. Key concepts include

- needs (food, air, water, light, and a place to grow);
- parts (seeds, roots, stems, leaves, blossom, fruit); and
- characteristics: edible/nonedible, flowering/nonflowering, evergreen/deciduous.

Understanding the Standard

Young children have a natural curiosity about the living things that they encounter. Observation is a method by which students can answer questions about how plants live, their parts and characteristics. All plants need nourishment, air, and a place to grow. They have specific structures to meet their needs. Students need to know the concepts, not the definitions, of the terms edible, nonedible, evergreen, and deciduous. They need to know that we eat certain plants (edible) but not others (nonedible). They need to know that some plants stay green all year long (evergreen) while others lose their leaves each fall (deciduous). The concepts in this standard build upon the Life Processes strand (K.6), in which students investigate and understand basic needs and life processes of plants and animals. It is intended that students will actively develop science investigation, reasoning, and logic skills (1.1) in the context of the key concepts presented in this standard.

Standard 1.4

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• Plants have basic needs, including food, air, water, light, and a place to grow.• Plants have different structures that serve different functions in growth, survival, and reproduction.• The functions of plant parts include roots holding plants in place and absorbing water, seeds making new plants, leaves making food for the plant, stems holding the plants upright and transporting materials up and down the plant.• Plants can be categorized by their different characteristics, such as edible/nonedible, flowering/nonflowering, evergreen/deciduous.	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none">• conduct simple experiments/investigations related to plant needs by changing one variable at a time. Students do not need to know the term variable.• create and interpret a model/drawing of a plant, including roots, stems, leaves, blossoms, fruits, and seeds.• identify the functions of the root, stem, leaf, and seed.• classify plants by the characteristics of edible/nonedible, flowering/nonflowering, and evergreen/deciduous using tables, charts, and picture graphs.

Strand: Life Processes

Standard 1.5

The student will investigate and understand that animals, including people, have life needs and specific physical characteristics and can be classified according to certain characteristics. Key concepts include

- life needs (air, food, water, and a suitable place to live);
- physical characteristics (body coverings, body shape, appendages, and methods of movement); and
- characteristics (wild/tame, water homes/land homes).

Understanding the Standard

This standard focuses on the idea that living things move, need food, breathe, and reproduce. Animals have a variety of ways in which they accomplish these activities. Each type of animal has features that allow it to function in unique and specific ways to obtain food, reproduce, and survive in a particular place. This standard builds upon the Life Processes strand (K.6), in which students investigate and understand basic needs and life processes of plants and animals. It is intended that students will actively develop science investigation, reasoning, and logic skills (1.1) in the context of the key concepts presented in this standard.

Standard 1.5

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• Animals, including people, have basic life needs including air, food, water and a suitable place to live.• Body coverings include hair, fur, feathers, scales, and shells.• Appendages are parts with specific functions that extend from the main body, such as arms, legs, wings, fins, and tails.• Methods of movement may include walking, crawling, flying, and swimming.• Simple ways to classify animals are whether they are wild or tame, and whether they live on land or in water.	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none">• make and communicate observations of live animals, including people, about their needs, physical characteristics, and where they live.• describe the life needs of animals including air, food, water, and a suitable place to live.• identify and chart simple characteristics by which animals can be classified, including body coverings (hair, fur, feathers, scales and shells), body shape, appendages (arms, legs, wings, fins, and tails), methods of movement (walking, crawling, flying, and swimming), wild or tame, and water homes or land homes.• distinguish between wild and tame animals and recognize examples of each.• infer types of animal homes (water or land) using the physical characteristics of the animals, such as scales and fins that allow fish to live and move in water, fur and legs that allow dogs to live and move on land.• classify animals by where they live (their homes).

Grade One Science Strand

Interrelationships in Earth/Space Systems

The strand focuses on student understanding of how Earth systems are connected, and how the Earth interacts with other members of the solar system. The topics developed include shadows; relationships between the sun and the Earth; weather types, patterns, and instruments; properties of soil; characteristics of the ocean environment; and organization of the solar system. This strand includes science standards K.7, 1.6, 2.6, 3.7, 4.6, 5.6, and 6.10.

Strand: Interrelationships in Earth/Space Systems

Standard 1.6

The student will investigate and understand the basic relationships between the sun and the Earth. Key concepts include

- the sun is the source of heat and light that warms the land, air, and water; and
- night and day are caused by the rotation of the Earth.

Understanding the Standard

This standard focuses on some of the important relationships between the sun and the Earth. Day and night occurs because Earth turns or rotates on its axis. Earth turns on its axis once a day. Students need to understand the concepts of rotation and axis, but they do not need to know the terms. This standard builds upon science standard K.7 about light and shadow. It is intended that students will actively develop science investigation, reasoning, and logic skills (1.1) in the context of the key concepts presented in this standard.

Standard 1.6

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• The sun is the source of light on Earth.• The sun provides heat, which warms the land, air, and water on Earth.• The rotation of Earth means that Earth turns once a day with the part of Earth facing the sun being in daytime and the part not facing the sun being in nighttime.	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none">• infer that sunlight striking an object makes the object warmer.• conduct simple experiments to show how sunlight changes the temperature of land, air, and water.• comprehend that day and night are caused by Earth's rotation.• compare and contrast day and night by characteristic changes in temperature and light.• demonstrate and describe the concept of rotation.• model the rotation of Earth and its physical relationship to the sun.• interpret the relationship between the sun's position in the sky and the general time of day. This includes the sun's relative position in the morning, at noon, and the late afternoon.

Grade One Science Strand

Earth Patterns, Cycles, and Change

The strand focuses on student understanding of patterns in nature, natural cycles, and changes that occur, both quickly and over time. An important idea represented in this strand is the relationship among Earth cycles and change and their effects on living things. The topics developed include noting and measuring changes, weather and seasonal changes, the water cycle, cycles in the Earth-moon-sun system, and change in the Earth's surface over time. This strand includes science standards K.8, K.9, 1.7, 2.7, 3.8, 3.9, 4.7, and 5.7.

Strand: Earth Patterns, Cycles, and Change

Standard 1.7

The student will investigate and understand the relationship of seasonal change and weather to the activities and life processes of plants and animals. Key concepts include how temperature, light, and precipitation bring about changes in

- plants (growth, budding, falling leaves, wilting);
- animals (behaviors, hibernation, migration, body covering, habitat); and
- people (dress, recreation, work).

Understanding the Standard

The focus of this standard is on temperature, light, and precipitation as they relate to life changes in plants, animals, and people. There are many ways to acquaint children with Earth science-related phenomena that they will come to understand later as being cyclic, and this standard introduces those ideas. It is enough for young children to observe the pattern of daily changes without getting deeply into the nature of climate. They should notice how these changes affect plants and animals. This is observable and can be charted over short and intermediate time periods. Students need to understand the concepts of migration, hibernation, and habitat, but they do not necessarily need to know the terms at first grade. This standard builds upon science standard K.8 in which students investigate and understand simple patterns in their daily lives. It is intended that students will actively develop science investigation, reasoning, and logic skills (1.1) in the context of the key concepts presented in this standard.

Standard 1.7

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• Seasonal changes bring about changes in plants, animals, and people.• With seasonal changes come changes in weather, including temperature, light, and precipitation.• Precipitation includes rain, snow, and ice (sleet, hail).• Changes in plants include budding, growth, wilting, and losing leaves.• Some animals hibernate and some animals migrate as a result of seasonal changes, resulting in changes in habitat.• The body coverings of some animals change with the seasons. This includes thickness of fur and coloration.• Changes in people include their dress, recreation, and work.	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none">• identify types of precipitation as rain, snow, and ice (sleet, hail) and the temperature conditions that result in each one.• relate a temperature and precipitation chart to the corresponding season (daily or weekly).• measure and chart changes in plants, including budding, growth, wilting, and losing leaves. Recognize in what season budding and wilting will most likely occur.• predict how an outdoor plant would change through the seasons.• compare and contrast the four seasons of spring, summer, fall (autumn) and winter in terms of temperature, light, and precipitation.• compare and contrast the activities of some common animals (e. g., squirrels, chipmunks, butterflies, bees, ants, bats, and frogs) during summer and winter by describing changes in their behaviors and body covering.

Standard 1.7 (continued)

Overview	Essential Knowledge, Skills, and Processes
	<ul style="list-style-type: none">• compare and contrast how some common plants (e. g., oak trees, pine trees, and lawn grass) appear during summer and winter.• comprehend the concepts of hibernation, migration, and habitat, and describe how these relate to seasonal changes. It may be useful to recognize common Virginia animals that hibernate and migrate, but specific names of animals is not the focus of student learning here.• infer from people's dress, recreational activities, and work activities what the season is.

Grade One Science Strand

Resources

The strand focuses on student understanding of the role of resources in the natural world and how people can utilize those resources in a sustainable way. An important idea represented in this strand is the concept of management of resource use. This begins with basic ideas of conservation and proceeds to more abstract consideration of costs and benefits. The topics developed include conservation of materials, soil and plants as resources, energy use, water, Virginia's resources, and how public policy impacts the environment. This strand includes science standards K.10, 1.8, 2.8, 3.10, 3.11, 4.8, and 6.11.

Strand: Resources

Standard 1.8

The student will investigate and understand that natural resources are limited. Key concepts include

- identification of natural resources (plants and animals, water, air, land, minerals, forests, and soil);
- factors that affect air and water quality;
- recycling, reusing, and reducing consumption of natural resources; and
- use of land as parks and recreational facilities.

Understanding the Standard

This standard focuses on identifying what natural resources are; basic ways we can help conserve those natural resources, especially water and air; and the preservation of land to use as parks. The standard extends the perception of young students from the present to the future and from self to their community. Standard K.10 establishes a foundation for this standard. It is intended that students will actively develop science investigation, reasoning, and logic skills (1.1) in the context of the key concepts presented in this standard.

Standard 1.8

Overview	Essential Knowledge, Skills, and Processes
<p>The concepts developed in this standard include the following:</p> <ul style="list-style-type: none">• Natural resources provide us with the things we need to live, including food, clothing, water, air, shelter, land, and energy.• Many natural resources are limited and cannot be renewed. Other resources are limited and cannot be renewed, but may last a very long time.• What we put into the air, especially the products of the fuels we burn, affects the quality of the air. Animal, including human, and factory wastes can affect the quality of water. Some pollution washes from yards, streets, and farms.• Recycling recovers used materials. Many materials can be recycled and used again, sometimes in different forms.• Resources will last longer if we recycle them, reuse them, or reduce consumption of them.• The creation of parks can help preserve land. Parks have many uses including recreation.	<p>In order to meet this standard, it is expected that students should be able to:</p> <ul style="list-style-type: none">• identify natural resources such as plants and animals, water, air, land, minerals, forests, and soil.• recognize that many natural resources are limited.• compare and contrast ways of conserving resources. This includes recycling, reusing, and reducing consumption of natural resources.• classify factors that affect air and water quality.• describe ways students and schools can help improve water and air quality in our communities.• determine some basic factors that affect water quality by conducting simple investigations in the school environment. Students should be able to make and record observations of what happens to runoff water on rainy days. (Related to 1.3.)• predict what would happen if natural resources were used up, and explain ways to prevent this from happening.• compare and contrast the value of parks to wildlife and to people.